

***TECHNOLOGY OF DEVELOPMENT
AND PRODUCTION IMPLEMENTATION OF ICE
CREAM WITHOUT "E" ADDITIVES, ENRICHED WITH
PREBIOTICS AND PROBIOTICS***

English title of the dissertation

Mgr inż. Wojciech Motyl

professional title name and surname of the author

Prof. hab. inż. Piotr Dziugan

Supervisor

Auxiliary supervisor

Abstract

The high competitiveness of the market and the increased interest in health-promoting products force manufacturers to create new products and innovative production technologies that will encourage potential customers to buy. The idea of a "clean label" is becoming more and more popular due to the great interest in healthy, unprocessed products and simple ingredients. Currently, products of this type are not yet popular in the assortment of ice cream available on the Polish market. Ice cream enriched with selected nutrients is in line with the prevailing food trends. An interesting proposal to increase the health benefits of ice cream may be the introduction of vitamins, mineral preparations, probiotic microorganisms, and dietary fiber into its composition. The health-promoting effects of dietary fibre are associated with its beneficial effects on the human gut microbiota. From a technological point of view, ice cream with the addition of a fiber preparation had a significantly longer melting time than ice cream without fiber. Another way to enrich ice cream is to add probiotics. Eating ice cream containing probiotics can show a positive effect on human health, mainly through the interactions with the immune system. In order to achieve the desired health effect as a result of the consumption of probiotic ice cream, it is necessary to estimate the minimum number of live probiotic bacterial cells necessary to guarantee the beneficial effects of the probiotic microbiota on the human body (e.g. for fermented milk beverages the therapeutic minimum is 10^6 - 10^7 cfu/g).

This doctoral dissertation was created for the purpose of developing recipes and implementing functional ice cream, which will include natural ice cream (without "E" additives) and ice cream with the addition of prebiotics and probiotics at Kilargo sp. z o.o.

Innovative research, including a doctoral dissertation, was aimed at developing a recipe for natural ice cream without "E" additives (in the most popular flavors), enriched with probiotic bacteria and prebiotic substances, and then developing a technology for the production of this ice cream.

The scope of research and implementation work included: selection of simple ingredients of natural equivalents for standard additives with "E" symbols; development of a recipe for natural ice cream without additives with "E" symbols (in the most popular flavors); technological tests on a laboratory scale, developmental work related to the launch of the technology and its adaptation to work in the existing system of an industrial installation; selection of probiotic bacteria in terms of resistance to the technological process and selection of prebiotic substances. In order to achieve the intended goal, industrial research was carried out at Kilargo sp. z o.o., plants in Kalisz and Chechło, and at the Lodz University of Technology in the Department of Environmental Biotechnology.

The conducted research allowed for the development of a recipe and technology for the production of ice cream with simple and natural ingredients without additives marked with "E" numbers, meeting the applicable physicochemical and microbiological requirements, with high organoleptic values. In addition, *in vitro* studies allowed for the selection of probiotic cultures that showed high survival during the technological process of ice cream production, at the functional level of 10^6 cfu/g and during their

2-year storage at -20°C, which guarantees a long shelf life of the product without losing its quality. The probiotic properties of the bacterial strains used in the production of ice cream were confirmed by demonstrating survival in the environment prevailing in the gastrointestinal tract. The commercial strains of lactic acid bacteria used in the study, dedicated to dairy products stored at low temperatures, did not show the presence of cold shock proteins. The selection of fiber preparations made it possible to select those that meet the criteria for prebiotics. In addition, recipes and technologies for the production of synbiotic ice cream were developed. Ice creams enriched with prebiotic and synbiotic preparations did not show any adverse organoleptic and physicochemical changes during the assumed 2-year storage period. Ice cream with simple and natural ingredients without “E” additives, as well as probiotic ice cream and ice cream enriched with synbiotics are characterised by a higher price, that is why they have now become an exclusive product, from a higher price range and are addressed to a selected group of conscious recipients. The developed ice cream technologies have been implemented at Kilargo sp. z o.o.